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RELOCATION OF PUBLIC HOSPITAL PATIENTS:

CHANGES IN PATIENT FUNCTIONAL STATUS

UNIVERSITY OF MASSACHUSETTS AT BOSTON

RELOCATION OF
PUBLIC HOSPITAL PATIENTS:

CHANGES IN
PATIENT FUNCTIONAL STATUS

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RELOCATION OF PUBLIC HOSPITAL PATIENTS: CHANGES IN PATIENT FUNCTIONAL STATUS

EXECUTIVE SUMMARY

In June, 1991 the Commonwealth of Massachusetts announced its intentions of closing three public chronic hospitals (Cushing, Rutland Heights, and Lakeville) as a cost-saving effort. Between July, 1991 and February, 1992, 332 patients were transferred from the closing facilities to alternative sites of care. Involuntary transfers of institutionalized elderly have long been considered as posing serious potential risks to the consequent health and/or longer-term survival of relocated patients. The general purpose of this study was to assess the possible adverse impacts of the patient transfers associated with these public facility closings. The specific aim was to assess whether patients who were relocated from the closing facilities experienced greater deterioration in functional status than would have otherwise been expected to occur had the hospitals remained open.

A quasi-experimental evaluation design with treatment and nonequivalent control groups was employed to test for possible impacts of the involuntary transfers on patient functional status after relocation. Because of data constraints, the experimental group was limited to 213 patients affected by the closures who were transferred to nursing homes within Massachusetts, and to analysis of changes in their functional status occurring after the relocations. Consistent, longitudinal functional-status data were obtained from Management Minutes Questionnaire (MMQ) data employed in the Medicaid case-mix reimbursement system for nursing homes in Massachusetts. Since MMQ data are available for all Medicaid nursing home residents, nonrelocated Medicaid patients residing in the same nursing homes as

the treatment group of transfer patients were used as a control group sample population. Comparisons of longitudinal trends in the functional-status levels of relocated patients to those of similar Medicaid control group patients in the same facilities provides a basis for assessing impacts of the facility closures. Less favorable trends in the functional status of public hospital transfer patients relative to the control group sample of similar nonrelocated nursing-home patients would suggest that there were adverse impacts associated with the involuntary transfers from the closing facilities.

Three different functional status measures were employed as outcome measures in the study: an activities of daily living (ADL) functional status measure, a cognitive/behavioral status measure, and a bowel/bladder continence measure. Multivariate regression models were estimated with a number of patient attributes likely to affect changes in functional status (e.g., age, gender, baseline functional status) specified as covariate factors to control for possible differences in the population composition of the two study population groups.

Given their baseline levels of functional status, the empirical analyses showed that public hospital transfer patients experienced fairly modest deterioration in functional status and behavioral/cognitive status, and a modest increase in incontinence problems in the year following their relocation. One year after relocation, public transfer patients had 4.27 ADL functional limitations (out of a maximum of five ADLs) relative to a baseline mean of 4.17 ADLs at the time of the transfer. Transfer patients with a baseline mean of 1.48 incontinence problems (out of a maximum of two problems) at the time of relocation had about 1.67 incontinence problems on average one year later. The mean number of cognitive/behavioral limitations of 0.87 (out of a maximum of two limitations) a year after relocation was only a little higher than the mean of 0.76 limitations at the time of the transfers.

While these changes were fairly modest, some of the adverse impacts of the relocation appear much larger when differences in the demographic composition and the baseline functional status of public hospital residents and the comparison group Medicaid residents from the same nursing homes were controlled for through multivariate statistical techniques. While no significant differences were found in changes of ADL functional status or cognitive/behavioral status over a year between transfer patients and other Medicaid nursing home residents in the multivariate regression models, significant differences were found for incontinence problems. The empirical findings suggest that relocated public hospital patients experienced increases of about 0.12 more incontinence problems in the year following transfer than nonrelocated Medicaid residents in the same nursing homes.

Overall, the multivariate empirical findings suggest that for the specific outcome measures studied the efforts of the state to limit potential adverse transitional impacts of the relocation on patients through careful planning and organization was relatively successful and the involuntary relocation of patients from public chronic disease hospitals appears to have resulted in only fairly modest increased prevalence of incontinence in the population of patients that were relocated. Nevertheless, future consideration of potential public facility closings should take account of these potential adverse impacts on patients in assessing the relative benefits and costs of facility closure.

I. INTRODUCTION

In June, 1991 the Commonwealth of Massachusetts publicly announced its intentions of closing three public chronic disease hospitals. In light of the poor physical condition of two of the hospitals (Cushing and Rutland Heights) and the low occupancy rate in the third hospital (Lakeville), a Special Commission on Facility Consolidation, appointed by the Governor, had concluded that less costly and higher quality care could be provided for the patients of these hospitals in private nursing-home and other chronic-care facilities. The Commission recommended the closure of these chronic disease hospitals (as well as six other institutional sites) and the provision of assistance for the transfer of patients to alternative sites of care. Between July 1991 and February 1992, 332 patients were transferred from the facilities being closed to these alternative sites. The majority of these patients were transferred to nursing homes in the state of Massachusetts.

Involuntary relocation has long been considered as posing serious potential risks to the consequent health and/or long-term survival of institutionalized elderly. Past empirical research has not fully supported the expected results, however. While some studies have shown higher than average mortality rates among older institutionalized residents after relocation from one facility to another, many other such studies have not found significant evidence of adverse effects of relocation on survival rates. A smaller number of studies have addressed the impacts of relocation on the health and on the functional-status level of relocated institutionalized elderly. The findings have been mixed as well.

The purpose of the study, reported on herein, was to assess the possible impact of the transfer of institutionalized patients, stemming from the recent closures of public chronic-disease hospitals, upon the functional status of relocated patients. A companion report contains an analysis of mortality rates of the relocated patients. The specific goal of this study was to assess whether recently transferred patients from the closed public hospitals experienced less improvement and/or more deterioration in their functional status than would have otherwise occurred had they not been relocated. Because of data constraints, this study has been limited to patients who were transferred to nursing homes within Massachusetts and to analysis of changes in the functional status of these patients that occurred after they were moved. Since consistent functional-status data were not available for the transferred patients prior to their relocation, the public hospital patients are compared to similar patients in the new facilities to which they were relocated.

The following section contains a brief summary of relevant past research concerning empirical evidence about the potential adverse impacts of relocation on the functional status of institutionalized patients. It is followed by a discussion of data sources and one on research methodology for the study undertaken. The fourth section contains empirical results from the descriptive and statistical analyses. The last section contains a discussion of the implications of the empirical findings of the study and concluding remarks.

II. PAST RESEARCH

The impact of relocation upon the mortality, health, and functioning of institutionalized patients has been heavily studied and debated over the last two decades (Schulz & Brenner 1977; Coffman, 1981; Borup & Gallego, 1981; Borup, 1983; Horowitz & Schulz, 1983). While past research has yielded mixed findings about the impact of interinstitutional relocations on patient mortality rates, it has become rather widely believed that such relocations are stressful but usually not life-threatening, and that negative impacts can be minimized through adequate preparation of patients for a relocation (Grant et al., 1992).

Studies that have investigated the impacts of relocation on changes in these patients' abilities to perform everyday functional tasks in relation to "activities of daily living" (ADL) scales have not produced consistent evidence of an adverse impact. Four studies of the relocation of patients to new facilities staffed by people they were unfamiliar with provide direct conflicting evidence on the direction of impact. Two studies (Bourestom & Tars, 1974; Chanfreau et al., 1990) found greater declines in functional status for relocated patients than for control group patients who were not relocated. The study population of Chanfreau et al. (1990) was comprised of long-stay psychiatric patients. On the other hand, two studies (Borup, Gallego, & Heffernan, 1980; Pino, Rosica, & Carter, 1978) actually found greater declines in functional abilities for control-group patients relative to relocated patients. Bonardi, Pencer, and Tourigny-Rivard (1989) and Bourestom and Tars (1974), found no difference between the functional-status changes experienced by patients who were relocated to a new facility served by the same staff as the old facility and those changes experienced by a control group of patients who were not relocated. Finally, Grant et al. (1992) found no significant differences in functional-status changes between control-group patients and a group of physically and mentally frail patients with significant nursing care needs who were relocated to a new facility with a mixture of familiar and unfamiliar staff.

With the exception of Chanfraneu et al. (1990) and Grant et al. (1992), the sample populations in the above studies were restricted to interviewable patients, who are likely to be less frail and hence less vulnerable to the stresses associated with relocation. Since the population of the closed public hospitals in Massachusetts appears to be more frail than the general population of Massachusetts Medicaid nursing home residents, and hence more similar to the populations studied by Chanfraneu et al. (1990) and Grant et al. (1992), it is reasonable to conclude that past research does not provide conclusive evidence about the expected impacts of relocation on the functional status of surviving patients.

III. DATA AND METHODOLOGY

A. Evaluation Design

Since the objective of this study was to assess whether patients who were involuntarily transferred from the closed chronic disease hospitals experienced adverse changes in functional status associated with the transfer that would not have occurred otherwise, it would have been desirable to observe the functional status of these patients, and a control group of otherwise similar chronic-disease-hospital patients who were not affected by a facility closure, both before and after the closure of the three hospitals. Unfortunately, consistent and/or complete functional-status data could not be obtained over time for such a design.

Consistent, longitudinal functional-status data after relocation could be obtained for all patients affected by the closures who were transferred to nursing homes in the state of Massachusetts from data employed in the Medicaid case-mix reimbursement system for nursing homes. Since these data are available for all Medicaid nursing home residents, a control group can be defined as being comprised of nonrelocated Medicaid patients residing in the same nursing homes to which the relocated patients were transferred. With appropriate controls for covariate factors likely to affect changes in functional status over time--such as age, gender, race, length of institutionalization, and baseline severity of functional disability level--trends in the functional-status levels of relocated patients could be compared to those of similar Medicaid patients in the same facilities. If it was found that relocated public-hospital patients experienced less favorable trends in functional status than the comparison sample of nonrelocated nursing-home patients, the assumption would be that the involuntary transfers made through the closing of the three public hospitals were likely to have adversely affected the relocated patients.

Employing nonrelocated nursing-home patients as a comparison or control sample for transferred public hospital patients suffers from the obvious shortcoming that residence in a public chronic-disease hospital versus a nursing home may reflect some unmeasurable factors that systematically differ between the two population groups of interest. To the extent that any unmeasurable factors distinguishing Medicaid public-hospital and nursing-home patients also affect changes in functional-status level over time, an effect that is ascribed to be associated with patient transfer because of closure may reflect in part an unmeasured baseline difference between the two population groups that would have existed if patients had not been transferred from public hospitals. While it is important to note this potential caveat concerning the control-group definition, the control-group definition has an important strength as well. For example, since both public-hospital transfer patients and control-group patients receive care in the same nursing homes, the empirical findings are unlikely to be systematically affected by possible quality-of-care differences among care sites. This would not necessarily be true if the control group were comprised of patients from other public hospitals that were not closed.

B. Data Sources

The principal data employed in this study were quarterly observations from the Management Minutes Questionnaire (MMQ), a structured survey instrument employed by the Massachusetts Department of Public Welfare for case-mix reimbursement on behalf of Medicaid nursing-home residents. In addition to patient and facility identifiers, nursing-home admission date, and selected demographic attributes of patients (gender, race, age), the MMQ contains items measuring patient functional status, cognitive impairment, and urinary/bowel incontinence. The MMQ is completed for all Medicaid patients either at the time of nursing-home admission or a conversion from private-pay to Medicaid-payer status. These entry-level data are updated for all Medicaid-eligible residents on a quarterly basis by each facility through the Management Minutes Questionnaire Turnaround Document (MMQTD). The MMQTD is used by facilities to record residents who were discharged or were no longer Medicaid-eligible since the previous quarter. For residents continuing in the same facility, the previously submitted MMQ data are updated by the facility only when a change has occurred since the last MMQ submission. For example, residents who were previously reported to be independent in their ability to dress themselves may later be reported to be totally dependent. Otherwise the facility does not alter resident data from the previous quarter or original MMQ submission. MMQ data have been recorded for case-mix reimbursement purposes for all Medicaid nursing-home residents since January 1991. MMQ data are submitted quarterly by all nursing-home facilities. MMQ facility submissions have been phased in cycles such that data for about one third of Medicaid-eligible residents are submitted each month of the year.[1]

Given the obvious financial incentives for a nursing home to overstate the severity of the Medicaid disability levels for population, the Massachusetts Department of Public Welfare routinely conducts annual audits of selected facilities for the purpose of validating the accuracy of reported MMQ data. Porell, Caro, and Silva (1993) conducted an analysis of data from a 1991 audit of 53 facilities that either had an exceptionally high aggregate reported MMQ score, or a very large change in aggregate MMQ score over time. The findings suggest that the reliability of MMQ data is comparable to that found for similar data that are not used for reimbursement purposes. More specifically, the analysis revealed that mean MMQ scores self-reported by nursing homes were only about 6 percent higher than those reported by Medicaid auditors. Analysis of facility-auditor differences in ADL functional-status items revealed even smaller biases. The rate of agreement was over 77 percent between auditors and facilities with respect to the number of reported ADLs for individual patients, and the mean number of ADL dependencies per patient reported by facilities was only 1.8 percent higher than that reported by Medicaid auditors. These rates are as good or better than results reported about ADL functional-status variables in a number of published studies or government reports (Burns et al., 1992; Gruenberg et al., 1989; Hogan et al., 1986; National Center for Health Statistics, 1982).

C. Public Hospital Transfer Sample

Since the MMQ data contain Medicaid identification numbers, it was possible to retrieve the MMQ records of any public hospital patient who was transferred to any nursing home in Massachusetts, and to link quarterly records together to yield a resident history following the transfer from the public hospital.[2] There were 341 patients transferred from the three closed public hospitals from July 1991 through February 1992. Of this total, 128 were transferred to nursing homes outside of Massachusetts or other hospitals or care sites that were not Medicaid-certified nursing homes. Included among these patients were patients who were subsequently transferred to a Massachusetts nursing home after the initial transfer from the closed public hospital. These patients had to be excluded from the analysis since we investigated the potential impact of the transfer necessitated by the closure of the public hospital. The few patients who were initially transferred to one Massachusetts nursing home and then subsequently transferred to another were not excluded from the study. However, their resident histories were censored at the point when a second transfer occurred. In total, MMQ records associated with the initial transfer of patients from a closed facility were successfully retrieved for 213 patients. Transfers from Cushing Hospital accounted for 174 of this total. Of the remaining 39 patients, 38 had been transferred from Rutland Hospital and one patient had been transferred from Lakeville Hospital. The study sample of 213 public hospital patients had been transferred to 89 different nursing homes in the state of

Massachusetts. With the exception of two nursing homes where 10 and 12 patients respectively had been transferred, most nursing homes admitted one or two of the transferred public-hospital patients.

D. Control Group Sample

A control-group sample of patients was drawn from the pool of nontransferred Medicaid patients residing in the same nursing homes as transferred public-hospital patients. Since the goal of the study was to assess the potential adverse impact of the involuntary relocation of public-hospital patients, most of which had been institutionalized in those facilities for many years, it was important to define a control-group sample of nursing-home patients with comparable lengths of stay in those nursing homes. A control group of 2,913 Medicaid nursing home residents was selected through a process involving three steps.

In the first step, all quarterly MMQ records were selected for each patient who already resided in any one of the 89 nursing homes to which public-hospital patients were transferred during the time period in which the transfers occurred (i.e. July 1991 through February 1992). This selection yielded 62,034 quarterly MMQ records for 11,992 nursing-home patients.

In the second step, a stratified sample was drawn from these 11,992 nursing-home residents that approximately matched the length of stay and nursing-home distributions of the public-hospital transfer patients. A frequency distribution was run of the year of public-hospital admission for the 195 transfer patients with data on their date of public hospital admission. This revealed a skewed distribution of lengths of stay prior to transfer. About 27 percent of public-hospital patients resided in the closed facility for 10 or more years prior to the transfer. While only 6 percent of transfer patients resided in the public hospital for less than one year before the transfer, more than half of the patients had lengths of stays of six years or less.

A frequency distribution of the year of nursing home-admission for the potential nursing-home-patient comparison group also revealed a skewed distribution, but with large numbers of patients with quite short lengths of stay. About 23 percent of residents were admitted within one year of July 1991. Another 19 percent of Medicaid nursing home patients resided there between one and two years, and only 7 percent had nursing home stays that exceeded 10 years. Length of stay categories were then aggregated into the following classes: (0-1 year, 1-3 years, 3-5 years, 5-10 years, and 10 years or more) for both public-hospital-transfer and nursing-home-resident populations. Since relatively few patients with lengths of stay of 10 years or more were found in the potential comparison groups, all patients with stays of 10 years or more were retained for the comparison-group sample. For each of the remaining length-of-stay categories, nursing-home residents were randomly sampled with a sampling proportion that would approximately yield a length-of-stay distribution which closely matched that of the public-hospital-transfer patients.[3]

Given the widely dispersed distributions of both nursing-home and public-hospital patients among the 89 nursing homes with transferred patients, comparison-group patients were generally sampled without regard to their nursing home residence. The only exception to this was that comparison-sample residents were explicitly oversampled from the two nursing homes that admitted 10 or more public-hospital transfer patients.

Since our interest was in comparing changes in the functional status of patients over time in transfer and comparison population samples, it was important that patients be observed over similar lengths of time. If the observation or exposure time for one group of residents at risk regarding a change in functional status was systematically longer than the exposure time for the other group, there was a greater chance that a change would be observed for patients with longer periods of risk exposure. To avoid this kind of potential bias, a hypothetical post-test admission date, called a pseudo-admission date, was randomly assigned to each comparison-group resident selected in the second step of the sample selection process. These pseudo-admission dates were selected to approximately match the temporal distribution of the first MMQ record, or the record corresponding to the nursing-home admission, for all public-hospital transfer patients. All comparison sample MMQ records for quarters prior to the randomly assigned pseudo-admission date were excluded from the comparison group sample file.[4] As a result the earliest MMQ records for the comparison-group nursing-home resident sample closely matched the quarters when the public-hospital transfer patients were admitted to nursing homes. The file for the comparison sample contained 15,345 quarterly MMQ records for 2,913 Medicaid nursing-home residents. The comparison sample and public-hospital transfer samples were then merged together for empirical analysis.

E. Outcome Measures

Three different measures were employed to compare changes in the functional and cognitive status of transfer patients with changes experienced by other Medicaid nursing-home residents: an activies of daily living (ADL) functional-status measure, a cognitive/behavioral-status measure, and a bowel/bladder incontinence-status measure. Each of these outcome measures is briefly discussed below.

ADL Functional Status. The functional status of patients was measured in terms of ability to perform the following activities of daily living (ADL) functions: bathing, toileting, dressing, transferring (walking or moving around), and eating. Dichotomous variables were constructed to distinguish patients with a need for assistance or with complete dependence from those able to perform the function independently. An aggregate count of ADL limitations was then constructed from the individual dichotomous ADL items. Since nursing-home patients may have disabilities or limitations not reflected in these functional-status measures, ADL counts may range from zero to five ADL limitations.[5] The higher the ADL count, the greater the level of patient functional-status disability.

Behavioral/Cognitive Status. Two MMQ survey instrument items were used to construct a simple unweighted measure for distinguishing patients with behavioral problems and/or cognitive difficulties. First, the MMQ contains a dichotomous item to record patients who display dependent or disruptive behavior (e.g., screaming, physically abusive, wandering, etc.) at least three times per week. Second, the MMQ contains a dichotomous item to distinguish patients who are disoriented or impaired in memory nearly every day in performance of basic ADL tasks, mobility, and adaptive tasks. A single, behavioral cognitive-impairment measure was constructed as the sum of the scores for these two dichotomous items. Patients who were both cognitively-impaired and who displayed behavioral problems received a score of two on the combined measure. Patients with either a behavioral or cognitive impairment problem received a score of one. All other patients were scored zero.

Incontinence Status. The MMQ survey instrument contains separate items pertaining to bladder and bowel incontinence. A single combined incontinence measure was constructed with a score of two for patients with both regular bladder and bowel incontinence. A score of one was assigned for patients with either regular bladder or bowel incontinence. All other patients received a score of zero. To be assigned as regularly incontinent, a patient had to either be incontinent on at least a daily basis or on a bladder/bowel retraining program.

F. Outcome Model Specification

Although the comparison nursing-home sample was carefully drawn with respect to the distribution of patient lengths of stay and nursing home-providers, the public-hospital transfer patients are still likely to differ from the comparison sample on a number of demographic and baseline functional-status measures that may affect changes in their status over time. Simple comparisons of average changes between the two groups may not reflect the effects of involuntary relocation if one of the two groups of patients is at greater risk for experiencing a deterioration in functional status. For example, if one group is comprised of older, or more functionally impaired patients at the baseline than the other group, the difference in case-mix between groups might account for much, if not all, of observed simple group differences in average changes in functional status. Accordingly, multivariate regression models had to be employed to statistically control for group differences in covariate factors that could potentially affect changes in the outcome measures over time.

Two kinds of multivariate regression models were estimated in the study:

- an annual outcome model based on patients as units of observation, and
- a quarterly outcome model based on MMQ patient-quarter records as units of observation.

Both of these models had similar specifications regarding functional form and independent variables. The annual model was based on changes in functional status over a one-year period immediately following the admission of transfer patients to a nursing home. While a year is clearly long enough for observing significant changes in functional status, one obvious drawback of the annual model is that a significant number of patients may die, be discharged home, or may transfer to another nursing home within the one-year time period. Since such patients must be excluded from the sample in estimation of an annual model of change, the empirical findings may be biased if the excluded patients differ systematically from those who remain as nursing-home residents for the entire year. For example, if the public-hospital patients who were most adversely affected by the involuntary relocation all experienced rapid deterioration in functional status and died within a year of the transfer, none of these patients would be included in the annual model, and the annual model of course would then understate the adverse impacts of relocation upon patient functional status.

Potential selection effects due to mortality or other unobserved factors affecting the likelihood of a year-long nursing-home residence were addressed by the additional estimation of a quarterly model with person-quarters as units of observation rather than patients.[6] A single patient with five quarterly MMQ records and four patients, each with only two MMQ quarter observations, would both produce four patient quarter observations for measuring changes in patient functional status between consecutive quarters. A patient who died with only two consecutive MMQ quarter observations would not be excluded from the quarterly model estimation sample. Such an individual would contribute one observation for measuring change in patient functional status. Patients who survived for one year or more in the same nursing home contributed at least four quarterly observations for parameter estimation.[7] To the extent that there are no systematic differences in the likelihood of surviving for more than one quarter of a year between the public-hospital and comparison-group sample patients, the estimated parameters of the quarterly model should not be biased by potential selection effects.

Following the approach of previous longitudinal research on nursing home outcomes, the dependent variable in both the annual and quarterly models was specified as the functional outcome measure in the next time period. The longitudinal measurement of change was reflected in the model through the specification of a baseline, or current time period, measurement of outcome as an independent variable.[8] The previous studies of Mitchell (1978), Kane et al. (1983), and Rohrer & Hogan (1987) all found dramatic increases in model fit when the outcome measure from the previous time period was used as an independent variable in predicting the outcome measure in a subsequent time period.

The general model specifications estimated for both annual and quarterly models are shown below for the three patient status outcome variables: ADL functional status (ADL), behavioral/cognitive status (BEHCOG), and incontinence (INCONT).

$$\begin{aligned} \text{ADL}_{t+1} = {} & \beta_0 + \beta_1\ \text{AGE} + \beta_2\ \text{AGE}^2 + \beta_3\ \text{MALE} + \beta_4\ \text{WHITE} + \beta_5\ \text{LOS} + \beta_6\ \text{LOS} > 1\ \text{YR} \\ & + \beta_7\ \text{PUBHOSP} + \beta_8\ \text{ADL}_t + \beta_9\ \text{BEHCOG}_t + \beta_{10}\ \text{INCONT}_t + \varepsilon \end{aligned}$$

$$\begin{aligned} \text{BEHCOG}_{t+1} = {} & \beta_0 + \beta_1\ \text{AGE} + \beta_2\ \text{AGE}^2 + \beta_3\ \text{MALE} + \beta_4\ \text{WHITE} + \beta_5\ \text{LOS} + \beta_6\ \text{LOS} > 1\ \text{YR} \\ & + \beta_7\ \text{PUBHOSP} + \beta_8\ \text{ADL}_t + \beta_9\ \text{BEHCOG}_t + \beta_{10}\ \text{INCONT}_t + \varepsilon \end{aligned}$$

$$INCONT_{t+1} = \beta_0 + \beta_1 \text{ AGE} + \beta_2 \text{ AGE}^2 + \beta_3 \text{ MALE} + \beta_4 \text{ WHITE} + \beta_5 \text{ LOS} + \beta_6 \text{ LOS} > 1 \text{ YR} + \beta_7 \text{ PUBHOSP} + \beta_8 \text{ ADL}_t + \beta_9 \text{ BEHCOG}_t + \beta_{10} \text{ INCONT}_t + \varepsilon_t^9$$

Baseline measurements of all outcome functional status variables (ADL_t, $BEHCOG_t$, and $INCONT_t$) are specified as independent variables since a change in any one of the outcome measures may be influenced by baseline measurement of others.[10] For example, a patient with behavioral/cognitive problems may be more likely to experience an increase in the number of ADLs than one without such deficiencies. The expected signs for all these baseline patient status variables are positive.

Several demographic variables were specified as covariate factors in the models. Patient functional status in the next time period was specified as a nonlinear quadratic function of age through the specification of both AGE and AGE^2 in the model. Under this quadratic specification the marginal effect of an additional year of age toward a deterioration in functional status (as measured by an increase in ADL limitations, behavioral/cognitive problems, or incontinence level) will not be constant for patients of all ages. Rather, the effect may vary with the age of the patient in itself. It is expected that the marginal effect of age is likely to increase with age. In other words, an additional year of age is likely to affect the risk of deterioration in patient status more for older nursing-home patients than for younger ones. An increasing marginal effect of age would be reflected in a negative regression coefficient for AGE and a positive coefficient for AGE^2.

Dummy variables were specified for patients' gender and race. MALE was specified as equal to unity for males and zero for females. WHITE was specified as equal to unity for white patients, and zero for other races. Two variables were specified concerning patients' length of stay. For public-hospital transfer patients, the length of stay pertains to residence in the public hospital prior to transfer. For the comparison sample of nursing-home patients, it is the length of residence in their nursing home as of July 1991. In addition to a simple linear specification of length of stay with the variable (LOS) a dummy variable (LOS > 1 YR) was specified to distinguish longer-term patients from those with the lengths of stay of one year or less.

Finally, a dummy variable (PUBHOSP) with a value equal to unity for public-hospital transfer patients was specified to capture any systematic differences in functional status that remain after statistically controlling any case-mix differences in baseline status, demographic factors, and length of residence. A significant positive coefficient for PUBHOSP would indicate that transferred public-hospital patients experienced greater increases in functional limitations, behavioral/cognitive problems, and/or incontinence problems than nursing home patients from the comparison sample, who were otherwise similar on all of the covariate factors specified as independent variables. Such a finding would suggest that the involuntary relocation of the public-hospital patients is likely to have adversely affected the functional status of the transferred patients.

IV. EMPIRICAL FINDINGS

A. Descriptive Analysis

Before presenting the empirical results from the multiple regression models, it is useful to show some descriptive statistics about the baseline patient functional status and

Table 1: Descriptive Statistics on Functional Status Levels and their Change for Public Hospital Transfer Patients and Control Group Samples

Variable	Comparison Nursing Home Sample Patients		Public Hospital Transfer Patients	
	Mean (Std. err.)	N	Mean (Std. err.)	N
Baseline Measures				
ADL functional status *	3.51 (0.04)	2,088	4.15 (0.11)	143
Behavioral /Cognitive status	0.80 (0.01)	2,088	0.76 (0.05)	143
Incontinence level *	1.14 (0.02)	2,088	1.48 (0.07)	143
Annual Change[1]				
ADL functional status *	0.258 (0.02)	2,088	0.104 (0.07)	143
Behavioral /Cognitive status	0.049 (0.01)	2,088	0.111 (0.05)	143
Incontinence level	0.148 (0.01)	2,088	0.188 (0.05)	143
Quarterly Change				
ADL functional status *	0.068 (0.005)	12,563	0.023 (0.014)	915
Behavioral /Cognitive status	0.001 (0.003)	12,563	0.013 (0.018)	915
Incontinence level	0.041 (0.003)	12,563	0.035 (0.013)	915

* Sample population differences are statistically significant at the 0.05 level.

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[1] Since higher scores on the baseline outcome measures reflect greater levels of disability, a negative (positive) change in status reflects an improved (worsened) disability status.

demographic characteristics of the two populations and the average changes in functional status experienced by members of the two population groups. Table 1 contains the sample mean values for baseline measures of patient functional status and the mean changes in functional status for one year and for one quarter of a year for both public-hospital transfer patients and the comparison group of nursing-home residents. The annual change data are based only on patients with at least five consecutive quarters of data in the same nursing home. The quarterly-change data are based on all patients observed for at least two consecutive quarters in the same nursing home.

The top portion of Table 1 contains baseline means for the three outcome measures. The data suggest that the public-hospital patients were a frailer group of elders at the point of their transfer to nursing homes than their counterparts already residing there. On average, public-hospital transfer patients had 0.64 more ADL disabilities and 0.34 more incontinence problems than nursing-home residents with comparable lengths of stay. Both of these group differences in means were statistically significant at the 5-percent level. The group means of behavioral/cognitive impairments did not differ significantly between public-hospital and nursing-home populations, however.

The middle and bottom portions of Table 1 contain means for functional-status changes between years and quarter years, respectively. Since larger values of the functional-status variables all reflect greater levels of disability, a negative (positive) change in functional status reflects improved (worsened) functional status over time. The mean annual change data suggest that public-hospital transfer patients actually experienced more modest deterioration in their ADL functional status over a year than their comparison group counterparts. Whereas public-hospital transfer patients who were observed for a full year experienced a modest 0.104 average increase in ADL functional limitations, the comparison group experienced an average increase of 0.258 ADLs over a year. The between-group difference was significant at the 0.05 level of statistical significance. Both population groups showed significant average annual increases in behavioral/cognitive and incontinence problems, but the between-group differences were not significant.

The bottom portion of the table shows the sample means for quarterly changes in the functional-status measures. Given the shorter time period over which patients were at risk for changes in functional status, most of the much smaller within-group mean quarterly changes were all statistically insignificant. Only the mean quarterly increase of 0.068 ADL limitations for comparison group patients was significantly different from no quarterly change. Consistent with the annual change data, only the between group-differences in mean quarterly change in ADL functional status was statistically significant. That is, comparison group patients experienced higher rates of quarterly increase in ADLs.

The data presented in Table 1 are suggestive of fairly modest levels of average deterioration in patient functional status among both population groups. The average annual changes in the prevalence of incontinence problems and ADL limitations for the transfer-patient group were only about 12.7 percent and 2.5 percent of baseline means, respectively. Even the average annual increase of 0.258 ADLs for comparison group patients represents less than an 8 percent increase over the baseline mean of 3.65 ADLs. However, these simple comparisons of sample means could conceal more significant differences between transfer patients and nursing-home residents if there are significant between-group differences in important covariate factors like age which may affect changes in functional status over time.

Table 2 contains the sample means of the demographic and length-of-stay covariates for the public-hospital transfers and the comparison group of nursing-home residents. Sample means are presented for both annual and quarterly models since the quarterly models do not exclude persons with continuous residence for only two or three consecutive quarter years. Differences between annual-model and quarter-model baseline means provide some insight about how the excluded population from the annual model differs from the rest of the sample populations. Comparing the annual model baseline means between the public-hospital and comparison groups, the average pre-transfer length of stay was only slightly longer for public-hospital transfer patients than for the comparison group of nursing-home residents. In spite of efforts to match the two population groups on pre-transfer for length of stay, it was still significantly longer for public-hospital patients than nursing-home patients in the larger quarterly-model study sample populations.

Probably the most important baseline difference between the public-hospital transfer patients and the comparison group is the younger average age of public-hospital transfer patients relative to the comparison group of nursing-home patients. On average, the public-hospital transfer patients were more than two full years younger than the comparison group despite the fact that the transferred patients had significantly higher average levels of ADL functional and incontinence problems at the baseline. To the extent that functional-status changes are very sensitive to increasing age in both groups, the differences in simple mean

Table 2: Descriptive Statistics on Covariate Factors for Control-Group Patient and Public-Hospital Transfer Patient Samples.

Variable	Nursing-Home Control-Group Patients Mean (Std. error)		Public-Hospital Transfer Patients Mean (Std. error)	
	Annual N=2,088	Quarterly N=12,563	Annual N=143	Quarterly N=915
AGE	81.67 * (0.24)	81.76 * (0.10)	78.52 (1.16)	78.90 (0.46)
MALE	0.207 (0.01)	0.211 (0.003)	0.217 (0.03)	0.233 (0.014)
WHITE	0.972 * (0.004)	0.973 * (0.001)	0.951 (0.018)	0.949 (0.007)
LOS (length of stay in years)	8.27 (0.13)	8.13 * (0.06)	8.67 (0.52)	8.68 (0.19)
LOS > 1 YR	0.920 * (0.006)	0.899 * (0.003)	0.846 (0.030)	0.843 (0.01)

* Sample population differences are statistically significant at the 0.05 level.

levels of change shown earlier in Table 1 may conceal adverse transfer impacts once between-group differences in age and other covariate factors are accounted for.

B. Multiple Regression Results

Table 3 contains the empirical results of the annual multiple regression models of changes in patient functional status. The first column of the table contains the results for the ADL functional-status outcome measure. Similar to the findings of earlier research, it is not surprising that the most important variable determining the number of ADL limitations a year in the future is the current level of ADL limitations. Greater levels of ADL disabilities were also significantly associated with patients with more recent behavioral and/or cognitive problems and incontinence problems. The quadratic relationship between age and level of ADL limitations was consistent with expectations. The significant negative coefficient for age and the positive coefficient for AGE^2 together suggest that age-related deterioration in ADL functional status largely occurs in nursing home patients older than 48 years. At this point, the marginal effects of an additional year of age begin to rise with increasing age.[11] No other demographic variables were statistically significant. A positive coefficient was found for the dichotomous length of stay dummy variable (significant at the 10 percent level) along with a significant negative coefficient for the continuous length of stay variable. Together these coefficients suggest that patients with lengths of stay exceeding one year experience greater increases in ADL limitations than patients with shorter tenures, but that this differential diminishes with increased length of stay for longer-stay patients. Finally, the estimated coefficient for the public-hospital transfer dummy variable was not statistically

Table 3: Multiple Regression Results for Annual Model of Patient Status Change

	Patient-Status Measure		
	ADL Functional Status	Behavioral/ Cognitive Status	Incontinence Level
Variable	Coefficient # Estimate (t-statistic)	Coefficient Estimate (t-statistic)	Coefficient Estimate (t-statistic)
AGE	-0.0191 ** (-1.66)	-0.0044 (-0.69)	-0.0379 (-0.52)
AGE^2	0.0002 * (2.36)	0.0001 (1.02)	0.0001 (1.24)
MALE	-0.0179 (-0.41)	-0.0113 (-0.47)	-0.0413 (-1.49)
WHITE	0.1025 (0.98)	-0.0345 (-0.60)	0.0429 (0.65)
LOS	-0.0079 * (-2.71)	-0.0018 (-1.15)	-0.0053 * (-2.82)
LOS > 1 YR	0.1266 ** (1.88)	-0.0421 (-1.13)	0.0096 (-0.23)
ADL	0.6995 * (44.52)	-0.0009 (-0.11)	0.1035 * (10.42)
BEHCOG	0.0854 * (2.98)	0.6989 * (43.99)	0.0774 * (4.28)
INCONT	0.1937 * (7.17)	0.0261 ** (1.73)	0.6055 * (35.42)
PUBHOSP	0.0111 (0.15)	0.0376 (0.91)	0.1211 * (2.58)
Constant	1.212 * (2.71)	0.4201 ** (1.69)	0.0801 (0.28)
Adjusted R^2	0.718	0.520	0.667
F-value	562.65 *	241.18 *	446.10 *
N	2,218	2,218	2,218

* Statistically significant at the 0.05 level.
** Statistically significant at the 0.10 level.

significant. After controlling for the specified baseline variables and demographic covariates, there was no longer any significant difference between public hospital transfer and comparison group patients in ADL functional status a year after the transfer.

The empirical results for the annual behavioral/cognitive status model in Table 3 revealed no emperical findings of note except that patients with higher baseline levels of behavioral/cognitive or incontinence problems were more likely to have similar or increased behavioral problems a year later. The small positive coefficient for the transfer patient dummy variable was insignificant.

While the empirical results for the incontinence level model suggest no influence for demographic factors, baseline levels of ADL limitations, behavioral/cognitive problems, and incontinence levels were signifigant and positively associated with increasing incontinence problems over time. In contrast to the findings for ADL functional status, patients with longer lengths of stay were uniformly less likely to experience increased incontinence problems over time. The most notable finding, however, is the positive significant coefficient for the transfer patient dummy variable, suggesting that public hospital transfer patients were more susceptible to increasing problems of incontinence than their nursing home comparison sample counterparts. More specifically, the estimated coefficient suggests that transfer patients experienced about 0.12 more incontinence problems one year after their relocation than otherwise similar nursing home patients residing in the same facilities.

The empirical results for the quarterly change models are reported in Table 4. [12] Given that the quarterly model contains residents from both samples who were observed for less than one year and hence excluded from the annual model, it is possible that some

Table 4: Multiple Regression Results for Quarterly Model of Patient Status Change

	Patient Status Measure		
	ADL Functional Status	Behavioral/ Cognitive Status	Incontinence Level
Variable	Coefficient Estimate	Coefficient Estimate	Coefficient Estimate
	(t-statistic)	(t-statistic)	(t-statistic)
AGE	-0.0042	-0.0053	-0.0002
	(-1.40)	(-0.28)	(-0.10)
AGE^2	0.0001 *	0.0000	0.0000
	(2.12)	(0.64)	(0.80)
MALE	-0.0070	0.0075	-0.0109
	(-0.62)	(1.05)	(-1.39)
WHITE	0.0205	-0.0071	0.0082
	(0.75)	(-0.41)	(0.43)
LOS	-0.0016 *	-0.0008 **	-0.0015 *
	(-2.12)	(-1.73)	(-2.81)
LOS > 1 YR	0.0148	-0.0201 *	-0.0076
	(0.91)	(-1.98)	(-0.69)
ADL	0.8775 *	0.0062 *	0.0618 *
	(204.21)	(2.32)	(21.07)
BEHCOG	0.0334 *	0.8394 *	0.0315 *
	(4.44)	(178.46)	(6.14)
INCONT	0.0945 *	0.0185 *	0.8110 *
	(12.86)	(4.02)	(161.49)
PUBHOSP	-0.0028	-0.0024	0.0323 *
	(-0.15)	(0.45)	(2.48)
Constant	0.4100 *	0.1157	-0.0225
	(3.45)	(1.56)	(-0.28)
Adjusted R^2	0.882	0.744	0.840
F-value	10,052.74 *	3,888.57 *	7,028.69 *
N	13,393	13,393	13,393

* Statistically significant at the 0.05 level.
** Statistically significant at the 0.10 level.

findings may differ from those in the annual models. Overall, however, the empirical findings were very similar to those found in the annual models. The results for the quarterly model of ADL functional status in the first column indicate the significance of the three baseline variables for functional status, behavioral problems, and incontinence problems. While the squared age term was only statistically significant at the 5 percent level, age was again found positively associated with increased levels of ADL functional limitations under an increasing quadratic function with a minimum point of about 50 years. In contrast to the annual model findings, length of stay was found to be negatively associated with increasing ADL limitations uniformly over the entire range of length of stay. The estimated coefficient for the transfer patient dummy variable was miniscule and statistically insignificant. [13]

The empirical findings for the quarterly behavioral cognitive status model again did not yield a significant coefficient for the transfer patient dummy variable. The most notable difference from the annual model findings presented earlier is the significant negative coefficients found for the two length of stay variables. These estimated coefficients suggest that the likelihood of increased behavioral/cognitive problems diminishes for patients with longer tenure of stay in the nursing home.

With the exception of the additional significance of the baseline length of stay variables, the quarterly model findings for behavioral-cognitive status were consistent with those found from the annual model. No significant difference was found in behavioral/cognitive status changes between public hospital transfer patients and other nursing home residents.

The empirical findings for quarterly changes in incontinence levels were very similar to those reported earlier from the annual model. Baseline levels of incontinence, behavioral/cognitive problems, and ADL functional status were highly significant. Length of stay was significant and negatively associated with increased incontinence problems. The positive and highly significant public hospital transfer dummy variable is consistent with the annual model findings that relocated public hospital patients were more likely to experience increased incontinence problems relative to otherwise similar nursing home patients. The implied effects of relocation a year after transfer, amounting to an increase of about 0.126 more incontinence problems (i.e., 4 quarters x 0.0315 more problems per quarter), are nearly equal to that found in the annual model.

V. DISCUSSION AND CONCLUSIONS

The raw unadjusted data on average changes in ADL functional-status and incontinence levels for relocated public hospital patients suggest rather modest changes over the course of the year following their transfer to nursing homes. The average annual increases of 0.104 ADL limitations and 0.188 incontinence problems actually appear to be relatively modest in comparison to baseline mean levels of 4.17 ADL limitations and 1.48 incontinence problems for public hospital transfer patients. Glickman and Caro's (1993) findings regarding the extreme care and concern on the part of the staff that accompanied the actual physical process of patient relocation together with these findings of modest changes in patient status suggest that the successful handling of the physical relocation process may have reduced the potential adverse impacts that could have occurred as a result of the involuntary relocation. These results are likely to be viewed as favorable from the perspective of advocates of the public hospital closings.

Once differences in baseline patient status levels and demographic composition between public hospital patients and other Medicaid residents in the nursing homes to which they were transferred were controlled for through multivariate statistical analysis, the only significant adverse impacts of relocation appear to be those on incontinence levels. The estimated parameters from the annual and quarterly regression models suggest that on average relocated public hospital patients experienced from about 0.12 more incontinence problems in the year following transfer than otherwise similar nursing home patients at the time of transfer. In other words, the involuntary transfer of these patients was accompanied by modest but still larger deteriorations in continence levels than would otherwise likely have occurred in the absence of the public hospital closings.

Overall, the multivariate empirical findings suggest that, for the specific outcomes studied, the efforts of the state to limit potential adverse transitional impacts of the relocation on patients through careful planning and organization was largely successful. The involuntary relocation of patients from public chronic disease hospitals appears to have resulted only in increased prevalence of incontinence in the population of patients who were relocated. Nevertheless, future consideration of potential public facility closings should take account of these potential adverse impacts on patients in assessing the relative benefits and costs of facility closure.

END NOTES

1. One group of facilities submits data in the months of January, April, July, and October. The other two groups submit data in the months of February, May, August, and November, and March, June, September, and December, respectively.

2. The MMQ records of most of the patients from the closed facilities were retrieved by matching Medicaid identification numbers. For all transferred public hospital patients whose Medicaid identification number could not be matched to any MMQ records, we retrieved all MMQ records with the same surnames as the transferred patients as well. Sixteen successful matches were achieved on the basis of identical surnames with consistent age and gender information between public hospital and MMQ records. In these cases, the Medicaid identification number derived from public hospitals was incorrect presumably because of coding errors.

3. For example, given that there were 624 nursing-home residents with lengths of stay of 10 years or more retained in the comparison sample, the expected number of residents with a length of stay of 1 year or less under the public-hospital length-of-stay distribution was only 144. Since there were about 2,752 potential comparison nursing-home residents with stays of one year or less, a random sample of 5.2 percent (144/2752) was selected from the pool of residents in this stratum.

4. For example, a nursing-home resident with a length of stay of 10 years may have nine MMQ records on file starting in the first quarter of 1991 through the first quarter of 1993. If a pseudo-admission date of September 1991 was assigned to this resident, then all MMQ records for that resident prior to September 1991 would be excluded from the analysis. As a result, the comparison-group resident would be observed over roughly the same time period as transfer patients.

5. Two variants of this ADL measure were also tested. In one alternative measure only patients with a severe disability were distinguished as having a functional impairment. Patients with moderate impairments were grouped with those having no impairment. In the other alternative, patients with severe disabilities received a score of two; patients with moderate disabilities received as score of one, and those with no impairments were scored zero. The empirical results were not found to differ very much qualitatively under the various scoring methods. Hence, we only will only report the empirical findings associated with the simplest and most commonly employed method of scoring functional impairments.

6. In addition, a two-equation sample selection model estimation approach was employed to estimate the parameters of the annual functional-status outcome model. Under this estimation approach pioneered by Heckman (1979), a sample selection model is estimated first. The dependent variable in this first model distinguishes patients who were observed as nursing-home residents for the entire year from those who were not observed for the entire year because of death, relocation, or other reasons. The estimated sample selection model is then used to construct a selection factor that is included as an extra independent variable in the second-stage annual patient outcome model estimated only on patients observed for an entire year. This selection factor essentially reflects the level of hazard or risk that individuals with the same observed covariate factors as patients observed for an entire year who were excluded from the second-stage model. By including the selection factor as an independent variable in the second stage model, consistent parameter estimates can be obtained. Since the estimated parameter for the selection factor was not found to be statistically significant and since its inclusion did not affect the empirical results, only the simple annual regression model results will be reported here.

7. A patient with exactly five MMQ quarterly records would have observations of potential change between quarters 1 and 2, quarters 2 and 3, quarters 3 and 4, and quarters 4 and 5. The fifth quarter record will contain data on functional status about one year later than the first quarter record.

8. This "next-period" model is equivalent to one in which the change in patient status serves as the dependent variable and the baseline patient status measure is specified as an independent variable. The "next-period" model was employed in the study rather than the alternative "change" model because the estimated parameters are easier to interpret.

9. The term ε is a random disturbance term assumed to be normally distributed with constant variance and zero covariances.

10. Initially a series of baseline dummy variables corresponding to one, two, three, four, or five ADLs were specified to test for possible nonlinearities in the relationship between baseline and future levels of ADL limitations. Since the relative sizes for the coefficients of the individual dummy variables were nearly linear, a single baseline variable was specified to capture the apparent linear relationship.

11. The signs of the coefficients for the unsquared and squared AGE terms suggest a U-shaped quadratic relationship. Using simple calculus, the minimum point on the curve was solved to be about 65.8 years.

12. Since the same nursing home resident accounts for multiple observations in the quarterly model, the common assumption of uncorrelated disturbance terms among observations is unlikely to be plausible. The consequence of this is that the standard errors of the regression coefficients are likely to understate the true sample variance of the parameter estimates and the t-statistics are likely to be upward biased. While the degree of bias is unlikely to be large, caution should be exercised in interpreting coefficients that are not significant at high levels of statistical significance.

13. An additional model specification was tested which contained dummy variables for the first each of the first four quarters of MMQ data for each patient, and interaction terms between each of these quarter dummy variables and the PUBHOSP dummy variable. If the more rapid deterioration in functional and incontinence status of transfer patients was concentrated in the quarters immediately following relocation, this would be reflected in positive coefficients for the interaction terms noted above. The failure to find any specific quarter dummy variable or interaction term significant suggests that the failure to find significant adverse impacts on ADLs and behavioral/cognitive problems was not due to these effects being concentrated in the first few quarters following transfer.

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GERONTOLOGY INSTITUTE

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